REMARKS

Claims 1-10 and 12-20 are amended herein. No new claims have been added.

Claims 1-20 are pending in the application and are presented for reconsideration. The remaining independent claims are claims 1, 12 and 17. Based on the above Amendment and the following Remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections, and withdraw them.

The amendments to the specification and the claims are believed not to introduce new matter, and their entry is respectfully requested. Claims 1-10 and 12-20 have been amended merely to more clearly define the invention and to provide proper antecedent basis.

Applicants thank Examiner for allowing Examination to proceed with informal drawings. Per Examiner's instructions, formal drawings will be submitted in a timely manner.

Applicants thank Examiner for initialing the Information Disclosure Statement filed on July 1, 2002. Applicants request Examiner to kindly review and initial the supplemental Information Disclosure Statement filed on December 15, 2005.

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Amendments to the Specification

As provided in 37 C.F.R. §1.77(b) & (c), the specification has been amended merely to identify the various sections of the application with appropriate section headings. Examiner is respectfully requested to enter the amendments to the specification. It is also respectfully requested that the Examiner explicitly approve these amendments in the next official communication.

Rejections under 35 U.S.C. §101

The Examiner has rejected claims 1-20 under 35 U.S.C. §101 as being directed to non-statutory subject matter because the claims allegedly lack a practical application. Examiner alleges that the claimed invention lacks a tangible result because the claims are directed to an abstract mathematical algorithm. Examiner also alleges that the claims do not provide a concrete result.

Based on the above amendment and the following Remarks, Applicants respectfully request that the Examiner reconsider these rejections, and withdraw them.

Under the Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility issued by USPTO Commissioner John Doll on October 26, 2005 (hereinafter "Patentability Guidelines"), the claimed invention as a whole must be useful and it must accomplish a practical application. That is, the invention must produce a "useful, concrete and

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tangible result." Patentability Guidelines § II(A); citing State Street Bank & Trust Co. v. Signature Financial Group Inc., 149 F. 3d 1368, 1373-74, 47 USPQ2d 1596, 1601-02 (Fed. Cir. 1998).

In State Street, the Federal Circuit examined some of its prior section 101 cases, observing that the claimed inventions in those cases were each for a "practical application of an abstract idea" because the elements of the invention operated to produce a "useful, concrete and tangible result." Patentability Guidelines, Annex II(B)(ii); citing State Street, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02. For example, the court in State Street noted that the claimed invention in Alappat "constituted a practical application of an abstract idea (a mathematical algorithm, formula, or calculation), because it produced 'a useful, concrete and tangible result' – the smooth waveform." Id. Similarly, the claimed invention in Arrhythmia Research Technology Inc., v. Corazonix Corp., 958 F.2d 1053, 22 USPQ2d 1033 (Fed. Cir. 1992), "constituted a practical application of an abstract idea (a mathematical algorithm, formula, or calculation), because it corresponded to a useful, concrete and tangible thing - the condition of a patient's heart." Id.

In determining whether a claim is for a "practical application," the focus is not on whether the steps taken to achieve a particular result are useful, tangible and concrete, but rather that *the final result achieved* by the claimed invention is "useful, tangible and concrete." Patentability Guidelines § IV(C)(2)(b) (emphasis in original). Similar to Alappat, where the Federal Circuit held that a smooth waveform representing data was a useful, concrete and

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tangible result, the claimed invention provides the useful, concrete and tangible result of an optimized model, structure, shape or design representing a physical object.

Similar to how the claimed invention in Arrhythmia constituted a practical application (and recited patentable subject matter under 101) because it corresponded to the condition of a patient's heart, the claimed invention constitutes a practical invention because it corresponds to a model, structure, shape, or design representing a physical object. Accordingly, Applicant submits that the claimed subject matter does satisfy the 101 requirements set forth by the courts and even by the PTO's new guidelines, cited above.

Independent claims 1, 12 and 17 are hereby amended to recite a "computer based" method for optimizing a model, structure, shape or design. Independent claims 1 and 12, as amended, are directed to "optimizing one of a model, structure, shape and design *representing a physical object* based on an evolution strategy." Independent claim 17, as amended, is directed to "optimizing a *spline coded structure* based on an evolution strategy." As explained above, claims 1-20 provide a useful, concrete and tangible result because they are directed to optimizing a model, structure, shape or design representing a physical object such as a spline coded structure. Original specification filed on February 21, 2002 (hereinafter "specification"), page 1, lines 9-10; page 8, line 25 to page 9, line 25; page 12, lines 4-11. As recited in amended claim 19, other examples of optimizing a model, structure, shape or design representing a physical object include optimizing the design of airfoils, compressor/turbine blades for gas turbines and other aerodynamic or hydrodynamic structures. Specification, page 1, lines 9-12; page 9, lines 30-33; page 13, lines 1-13.

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Applicant believes that all of the pending claims 1-20 recite patentable subject matter for at least the reasons set forth above and request that the Examiner reconsider and withdraw this rejection.

Rejections under 35 U.S.C. §102

The Examiner has rejected claims 1-13 and 15-18 under 35 U.S.C. §102(b) as allegedly being anticipated by an article entitled Evolutionary Computation: Comments on the History and Current State, by Bäck, T, et al., IEEE Transactions on Evolutionary Computation, April 1997, Vol. 1, No. 1, pp. 3-17 (hereinafter referred to as "Bäck").

Based on the following Remarks, Applicants respectfully request that the Examiner reconsider these rejections, and withdraw them.

Pending independent claims 1, 12 and 17, as amended, recite:

1.   A computer based method of optimizing one of a model, structure, shape and design representing a physical object based on an evolution strategy, comprising:
    describing one of the model, structure, shape and design representing the physical object
        to be optimized using a parameter set comprising object parameters;
    creating offsprings of the parameter set by modifying the object parameters, wherein said
        modifying includes at least one of mutating the object parameters and
        recombining the object parameters;
    evaluating quality of the offsprings;
    wherein the parameter set comprises at least one strategy parameter representing a step-
        size of the mutation of associated object parameters; and

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adapting a number of the object parameters and a number of associated strategy
    parameters during optimization.

12.   A computer based method of optimizing one of a model, structure, shape and
design representing a physical object based on an evolution strategy, comprising:
    describing one of the model, structure, shape and design representing the physical object
        to be optimized using a parameter set comprising object parameters;
    creating offsprings of the parameter set by mutating of the object parameters and a
        structure of the parameter set, the structure of the parameter set defined by a
        number and position of the object parameters and strategy parameters; and
    evaluating quality of the offsprings;
    wherein the parameter set comprises at least one strategy parameter representing a step-
        size of the mutation of associated object parameters.

17.   A computer based method for optimizing a spline coded structure based on an
evolution strategy, comprising:
    describing the spline coded structure to be optimized using a parameter set comprising
        object parameters representing control points and knot points and at least one
        strategy parameter representing a step-size of a mutation of associated object
        parameters;
    mutating the object parameters and strategy parameters to create offsprings of the set ,
        comprising:
        determining a control point insertion,
        inserting the control point in the parameter set,
        inserting a strategy parameter for the inserted control point,
        determining the knot points modified by the insertion of the control point,
        determining a weighted averaging of strategy parameter values of modified
            control points, and
        assigning the weighted average value as a value of the inserted strategy parameter;
            and
    evaluating quality of the offsprings.

The invention recited in independent claims 1, 12 and 17 relates to methods for

optimization based on an evolution strategy by describing a model, structure, shape or design

representing a physical object to be optimized using a parameter set comprising object

parameters, creating offsprings of the parameter set by modifying object parameters and/or

strategy parameters, and evaluating quality of the offsprings. For example, the method of claim

17 is directed to optimizing a spline coded structure.

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In independent claims 1, 12 and 17, the number and/or position of object parameters and/or strategy parameters are changed during the optimization. As recited in claim 1, the number of object parameters and the number of associated strategy parameters is adapted during the optimization. As recited in claim 12, offsprings of the parameter set are created by mutating the object parameters as well as the structure of the parameter set, wherein the structure of the parameter set is defined by the number and position of the object parameters and strategy parameters. As recited in claim 17, offsprings of the parameter set are created by inserting a control point and an associated strategy parameter in the parameter set. In the rejection, Examiner alleges that Bäck discloses these features at pages 4-5 and 7.

Contrary to Examiner's assertion, Bäck contains no hint or suggestion of these features. The cited paragraph on page 7, left column of Bäck, which refers to Schwefel, relates to the self-adaptation of the step size of the mutation, which is a feature of conventional evolutionary algorithms as explained by the Applicants on page 3, lines 1-5 of the specification. Bäck merely describes the self-adaptation of a given (fixed) number of strategy parameters. However, Bäck fails to disclose or suggest adapting the number and/or position of object parameters and associated strategy parameters, mutating the structure of the parameter set, or inserting a control point and an associated strategy parameter in the parameter set, as recited in independent claims 1, 12 and 17. In contrast to the present invention, the object variables and strategy parameters are actually taken as constant in Bäck. Therefore, Bäck neither discloses nor suggests adapting the structure of the parameter set by changing the number and/or position of object parameters and associated strategy parameters. Since Bäck neither discloses or suggests these elements of

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independent claims 1, 12 and 17, Applicants submit that rejection of claims 1, 12 and 17 is incorrect and respectfully request that the Examiner reconsider and withdraw the rejection of claims 1, 12 and 17.

Claims 2-11 depend from claim 1 and thereby incorporate all the limitations of claim 1. Therefore, all arguments advanced above with respect to claim 1 are hereby incorporated so as to apply to claims 2-11.

Claims 13 and 15-16 depend from claim 12 and thereby incorporate all the limitations of claim 12. Therefore, all arguments advanced above with respect to claim 14 are hereby incorporated so as to apply to claims 13 and 15-16.

Claim 18 depends from claim 17 and thereby incorporates all the limitations of claim 17. Therefore, all arguments advanced above with respect to claim 17 are hereby incorporated so as to apply to claim 18.

Rejections under 35 U.S.C. §103

The Examiner has rejected claims 14 and 19 under 35 U.S.C. §103(a) as allegedly being unpatentable over Bäck in view of Weinert, K, et al., Discrete NURBS-Surface Approximation Using an Evolutionary Strategy, REIHE CI 87/00, SFB 531, 2000, pp. 1-7 (hereinafter referred to as "Weinert").

The Examiner has rejected claim 20 under 35 U.S.C. §103(a) as being unpatentable over Bäck in view of Official Notice.

Claim 14 depends from claim 12 and thereby incorporates all the limitations of claim 12. Therefore, all arguments advanced above with respect to claim 12 are hereby incorporated so as to apply to claim 14.

Claims 19 and 20, as amended, depend from claim 1 and thereby incorporate all the limitations of claim 1. Therefore, all arguments advanced above with respect to claim 1 are hereby incorporated so as to apply to claims 19 and 20.

Therefore, Applicants submit that the rejection of claims 14, 19 and 20 is incorrect and respectfully request that the Examiner reconsider and withdraw the rejection of claims 14, 19, and 20.

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Conclusion

Applicants believe that all of the stated grounds of objection and rejection set forth by the Examiner in the Office Action have been properly accommodated or addressed. Applicants, therefore, respectfully request that the Examiner reconsider all presently outstanding objections and rejections and withdraw them. The Examiner is invited to telephone the undersigned representative if it is felt that an interview might be useful for any reason.

Respectfully submitted
Markus Olhofer et al.

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